11-01-02

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

COMBINED PROCEEDING
FOR U.S. Patent No. 5,486,435

In re reissue application of Haase
Serial No. 09/733,392
Filed December 7, 2000

In re Haase
Reexamination Proceeding
Control No. 90/005,710
Filed April 24, 2000

EXAMINER: BARRY, C.

GROUP ART NO: 1724

Patent Owner's Docket
for Reissue: 27410/002RI
for Reexam: 27410/002RX

3rd Party Requester's Docket:
RE-US5846435

The Honorable Commissioner
of Patents & Trademarks
Washington, D.C. 20231

RESPONSE TO OFFICE ACTION OF AUGUST 30, 2002

Dear Sir:

This is a Response to the Office Action of August 30, 2002.

AMENDMENTS

In the Claims:

Please AMEND the claims as follows:

Please note, that the brackets ("[]") and underlining ("____") are made relative to the claims of the issued patent, not relative to the claims as last amended.

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1. (Six Times Amended)[1] A method for dewatering biological sludge that has been digested by a thermophilic digestion process at a temperature greater than about 115°F, comprising:

a. adding a polymeric quaternary ammonium compound[s], as primary component, to the biological sludge; and

b. adding a polyacrylamide to the biological sludge;

such that any combination[s] of the polymeric quaternary ammonium compound[s] and of the polyacrylamide[s] enhances dewatering of the sludge.

2. (Four Times Amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound[s are] is from the di-allyl di-methyl ammonium chloride (DADMAC) family.

3. (Five Times Amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound[s are] is [from] epichlorohydrin

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[1] The "times amended" is based on the following amendments:
(1) Reissue Amendment of 12/05/00 amended claims 1-3, 15, and 17-19;
(2) Reexamination Amendment of 2/5/01 amended claims 1 and 15;
(3) the "housekeeping" amendment of 4/18/01 amended claims 1-3, 15-19 (with 19 renumbered as "20" by the Examiner;
(4) the Combined Proceedings Amendment of 3/1/01 amended claims 1-7, 9, 10, 12, 13, 15, 16, 19 and 21;
(5) the Combined Proceedings Amendment of 3/4/01 amended claim 21;
(6) the Instant Amendment, amending claims 1-10, 12, 13, 15 and16.

di-methyl amine (epi-DMA) [family].

4. (Two Times Amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge and, upon formation of microflocs of the sludge from the polymeric quaternary ammonium compound, wherein the polyacrylamide is a cationic polyacrylamide and is added to form a floc that dewaters the sludge.

5. (Twice Amended) The method for dewatering biological sludge according to claim 4, wherein the polymeric quaternary ammonium compound and the cationic polyacrylamide are in an approximately 1:1 ratio, with the cationic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound does.

6. (Twice Amended) The method for dewatering biological sludge according to claim 4, wherein ratio[s] of the polymeric quaternary ammonium compound with respect to the cationic polyacrylamide ranges from about 1:10 to about 20:1.

7. (Twice Amended) The method for dewatering biological sludge according to claim 4, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent.

8. (Amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge, in an amount sufficient to cause formation of a cationic overcharge within a developed microfloc system, [and an] wherein the polyacrylamide is a anionic polyacrylamide [is then] added for final floc formation.

9. Cancelled.

10. (Twice Amended) The method for dewatering biological sludge according to claim 8, wherein the polymeric quaternary ammonium compound and the anionic polyacrylamide are in an approximately 10:1 ratio, with the anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound [does].

11. The method for dewatering biological sludge according to claim 10, wherein the anionic polyacrylamide is about 40% anionic.

12. (Twice Amended) The method for dewatering biological sludge according to claim 8, wherein ratio[s] of the polymeric quaternary ammonium compound to the anionic polyacrylamide ranges from about 1:10 to about 20:1.

13. (Twice Amended) The method for dewatering biological sludge according to claim 8, wherein polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50

ppm:1 percent and approximately 300 ppm:1 percent.

14. The method for dewatering biological sludge according to claim 1, wherein the biological sludge is mixed with primary sludge.

15. (Six Times Amended) A composition comprising [for dewatering] biological sludge that has been digested by a thermophilic digestion process at a temperature greater than about 115°F, comprising polymeric quaternary ammonium compound[s], as primary component, and polyacrylamide, said components being present in the composition in a ratio to enable [the composition to function as an agent for] dewatering of the biological sludge [from a thermophilic digestion process].

16. (Three Times Amended) The method for dewatering biological sludge according to claim 1, wherein the polyacrylamide and the polymeric quaternary ammonium compound[s are] is used in solution or in dry form.

17. Cancelled.

18. Cancelled.

19. (Amended) The method of claim of claim 16 wherein the polyacrylamide is cationic or anionic.

20. (New) The composition of claim 15 wherein the polyacrylamide is cationic or anionic.

21. Cancelled.

Please ADD the following claims 22-71:

22. (Amended) A method for treating a sludge comprising water and solids, wherein the solids comprise thermophiles, wherein the thermophiles comprise bacteria living at termperatures of greater than about 115°F, the method comprising:

contacting the sludge with a polymeric quaternary ammonium compound and a polyacrylamide to form a treated sludge;

wherein the contacting of the sludge with the polyacrylamide and polymeric quaternary ammonium compound is simultaneous, or the contacting of the sludge is first with the polymeric quaternary ammonium compound and then with the polyacrylamide.

23. **PLEASE CANCEL THIS CLAIM**

24. (New) The method of claim 22, wherein the polymeric quaternary ammonium compound

comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

25. (New) The method of claim 22, wherein the polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of the thermophiles; and wherein the polyacrylamide is added in an amount sufficient to agglomerate the microflocs into flocs for dewatering.

26. (Amended) The Method of claim 25 wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

27. (New) The method of claim 25, wherein ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

28. (Amended) The method of claim 25, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

29. (New) The method of claim 22, wherein the polymeric quaternary ammonium compound is added in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge, and wherein the anionic polyacrylamide is added for final floc formation.

30. (Amended) The Method of claim 29 wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

31. (New) The method of claim 29, wherein ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

32. (Amended) The method of claim 29, wherein total concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

33. (Amended) A method for treating a sludge comprising water and thermophiles, wherein the thermophiles comprise bacteria living at temperatures greater than about 115° F, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

34. (Amended) The method of claim 33, wherein the polymeric quaternary ammonium

compound comprises a molecular weight in the range of greater than about 5,000,000.

35. (Amended) The method of claim 33, wherein the polymer is added in an amount sufficient to form microflocs of the thermophiles.

36. (Amended) The method of claim 35 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

37. (Amended) The method of claim 35, wherein a concentration of polymer to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

38. (Amended) The method of claim 33, wherein the polymer is added in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge, and wherein the anionic polyacrylamide is added for final floc formation.

39. (Amended) The method of claim 38 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

40. (Amended) The method of claim 38, wherein a concentration of polymer to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

41. (Amended)A sludge composition comprising:
water;
polyacrylamide;
a polymeric quaternary ammonium compound; and
solids comprising thermophiles, wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

42. **PLEASE CANCEL THIS CLAIM**

43. **PLEASE CANCEL THIS CLAIM**

44. (Amended) The sludge of claim 41, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

45. (Amended) The sludge of claim 41, wherein a ratio of the polymeric quaternary ammonium compound to the polyacrylamide is in the range of about 1:10 to about 20:1.

46. (Amended) The sludge of claim 41, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

47. (New) The sludge of claim 41, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

48. (Amended) A sludge composition comprising:
water;
a polyacrylamide;
a polymeric quaternary ammonium compound; and
solids comprising microflocs of thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

49. **PLEASE CANCEL THIS CLAIM**

50. **PLEASE CANCEL THIS CLAIM**

51. (Amended) The sludge of claim 48, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

52. (Amended) The sludge of claim 48, wherein a ratio of the polymeric quaternary ammonium compound to the polyacrylamide is in the range of about 1:10 to about 20:1.

53. (Amended) The sludge of claim 48, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

54. (New) The sludge of claim 48, wherein, the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

55. (Amended) A sludge composition comprising:
water;
a polyacrylamide;
a polymeric quaternary ammonium compound; and
solids comprising an agglomeration of microflocs of thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

56. **PLEASE CANCEL THIS CLAIM**

57. **PLEASE CANCEL THIS CLAIM**

58. (Amended) The sludge of claim 55, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl

ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

59. (New) The sludge of claim 55, wherein a ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

60. (Amended) The sludge of claim 55, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

61. (New) The sludge of claim 55, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

62. **PLEASE CANCEL THIS CLAIM**

63. **PLEASE CANCEL THIS CLAIM**

64. **PLEASE CANCEL THIS CLAIM**

65. **PLEASE CANCEL THIS CLAIM**

66. **PLEASE CANCEL THIS CLAIM**

67. (New) A sludge composition comprising:
water;
thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F; and
a polymeric quaternary ammonium compound.

68. (Amended) The sludgeof claim 67 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

69. (New) The sludgeof claim 67, wherein the polymer is present in an amount sufficient to form microflocs of the thermophiles.

70. (New) The sludgeof claim 67, wherein the polymer is present in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge.

71. (Amended) The sludge of claim 67, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of at least about 5,000,000.

REMARKS

THANKS FOR E-VERSION

Before addressing any issues of the Office action, applicant thanks Examiner Barry for kindly providing an e-version of the Office action, for use in preparation of this Response.

The e-version was subject to the following caveats, to which applicant agrees:

1. The response period continues to run from the 8/30/02 mail date. The sending of this e-mail correspondence does not reset or begin ANY new period for response EVEN IF this e-mail version includes any objection, rejection, or requirement for information that does not appear in the hard copy action mailed on 8/30/02, or is otherwise different in any respect from the version mailed 8/30/02. See no. 2. below.

2. To the extent that this electronic version includes any objection, rejection, or requirement for information that does not appear in the hard copy action mailed on 8/30/02, or is otherwise different in any respect from the version mailed 8/30/02, the hard copy version mailed 8/30/02 controls. Any discrepancies between this electronic version of the Office action mailed 8/30/02 and the hard copies mailed 8/30/02 and in the files themselves are inadvertent. Under no circumstances should or may any such discrepancies be misconstrued as the Office issuing a "new" ground of rejection requiring the resetting of any outstanding period for response.

3. Should Applicant make use of this electronic version in preparing his response to the outstanding action, he and/or his attorney must assume responsibility for reliance on any such inadvertent discrepancies between this unofficial electronic version attached hereto and the official action of record.

4. While the contents of this e-mail message will become part of the official record of the reissue application and reexamination proceeding (as an attachment to an interview summary), the attached electronic version of the text portion of the Office action mailed 8/30/02 will not in view of item 2. above.

5. Honoring your request in this case at this time does not establish a precedential practice or procedure within the Office by which you or any other applicant, requester, or owner has a right to receive any Office communication via e-mail unless provided for elsewhere by broadly applicable Office policy, practice, rule, or statute.

6. Applicant is reminded that the period for response to the August 30, 2002, Office action runs through OCTOBER 30, 2002. Today is October 24, 2002. As noted in previous official communications, extensions of time in this merged proceeding / application are governed by the reexamination proceeding extension of time rules (e.g., 37 CFR 1.550(c)) , not the

application extension of time rules (37 CFR 1.136).

REQUEST FOR INTERVIEW

The applicant respectfully requests a telephonic interview once Examiner Barry has had a chance to review the Response, and kindly requests that Examiner Barry will call to indicate his availability once he has reviewed this Response.

CLAIMS

Status of Claims

Prior to this Amendment

Pending: claims 1-8, 10-16, 19, 20, and 22-71.

Cancelled: claims 9, 17, 18 and 21.

After this Amendment

Pending: claims 1-8, 10-16, 19, 20, 22, 24-41, 44-48, 51-55, 58-61, and 67-71.

Cancelled: claims 9, 17, 18, 21, 23, 42, 43, 49, 50, 56, 57, and 62-66.

Support for Amendments/New Claims

Again, applicant notes that in the "Amendments," the brackets ("[]") and underlining ("____") are made relative to the claims of the issued patent, not relative to the claims as last amended.

To assist the Examiner, the following claims have been Amended, 1, 3, (4 was provided with underlining per the Examiner's instructions), 15, 19, 22, 26, 28, 30, 32-35, 37, 38, 40, 41, 44-46, 48, 51-53, 55, 60 and 71.

Claims 1 is amended to reflect the "temperature greater than about 115°F." Support for this can be found in col. 2, line 9.

Claims 3, 26, 30, 36, 39, 44, 51, 58, and 68 are amended to reflect that epi-DMA is

a single compound rather than a "family."

Claim 15 is amended to reflect the "temperature greater than about 115°F." Support for this can be found in col. 2, line 9.

Claim 19 is amended to change dependency from claim 15 to claim 16.

Claim 22 is amended to reflect the "temperature greater than about 115°F." Support for this can be found in col. 2, line 9. Claim 22 is also amended to define solids as comprising thermophiles. For support see, example, col. 6, lines 4-8.

Claims 28, 32, 37, 40, 46, 53 and 60, are amended to define the percentage on "solids." For support see, example, col. 6, lines 4-8.

Claims 34 and 71, are amended to define the molecular weight as being greater than about 5,000,000. Support can be found at col. 7, lines 10-15.

Brief Summary of Claims

To assist in the understanding of the claims, a brief summary of the claims is provided.

Independent claim 1 and dependent claims 2-8, 10-14, 16 and 19, recite a method.

Independent claim 15 and dependent claim 20, recite a composition.

Independent claim 22 and dependent claims 23-32, recite a method.

Independent claim 33 and dependent claims 34-40, recite a method.

Independent claim 41 and dependent claims 42-47, recite a composition.

Independent claim 48 and dependent claims 49-54, recite a composition.

Independent claim 55 and dependent claims 56-61, recite a composition.

Independent claim 62 and dependent claims 63-66, recite a composition.

Independent claim 67 and dependent claims 68-71, recite a composition.

Constructively Non-Elected / Withdrawn Claims

Claims 62 – 66 stand withdrawn from prosecution as having been constructively non-elected. The claims has been cancelled.

Specifically, the Office action notes these claims recite a copolymer having an acrylamide "moity" [sic, moiety] and a quaternary ammonium moiety, and as being directed to the "method three" invention, which was non-elected following a restriction requirement under 35 USC 121 during the prosecution of the '435 patent.

The Office action further notes, that the restriction requirement is repeated here but modified as follows: Method one and method two, having been examined in the patent's prosecution, are similarly joined together for examination here. Insofar as applicant has received an office action on the merits to claims directly solely to the previously elected method one and method two inventions, claimed 62 – 66 directed to a different invention are withdrawn from prosecution as having been constructively non-elected.

Applicant agrees and has cancelled claims 62-66.

Claim objections:

Claim 4 stands objected to under 37 CFR 1.121(b)(2) for want of the underlinings and bracketing to accurate reflect differences in the amended claim language vis-à-vis the text of the issued claim. The objection is respectfully traversed.

Specially, claim 4 has been amended with the required markings as kindly suggested by Examiner.

35 USC §112, §251 AND §132

Rejection

Claims 23, 42, 49, 50, 56, 57 stand rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed. Similarly, Claim 23 stands objected to under 35 USC §251 and §132 for addition of impermissible new matter. The rejection and objection are respectfully traversed.

In response, claims 23, 42, 49, 50, 56 and 57 have been cancelled.

Rejection

Claims 41 – 47, 49 stand rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed of the claimed subject matter. Similarly, Claims 41- 47stand objected to under 35 USC 251 and 35 USC 132 for impermissible introduction of new matter. The rejection and objection are respectfully traversed.

Specifically for claim 41, the Office action notes that the claim recites a sludge comprising "acrylamide," and further notes that while applicant may have support for a sludge comprising "polyacrylamide," nowhere could support for acrylamide be found.

In response, claim 41 has been amended to read "polyacrylamide."

Specifically, for claims 42, 43, and 49, the Office action notes that there is no support for "anionic colloidal material."

In response, claims 42, 43 and 49 have been cancelled.

Rejection

Claim 50 stands rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed. The rejection is respectfully traversed.

Claim 50 has been cancelled.

Rejection

Claims 28, 32, 37, 40, 46, 53, 60 stand rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed, and objected to under 35 USC 132 and 35 USC 251 for addition of new matter. The rejection and objection are respectfully traversed.

Specifically, the Office action notes that the application as filed refers to a ratio of polymer dosage relative to "percentage of solids component of the sludge."

In response, claims 28, 32, 37, 40, 46, 53 and 60 have been amended to recite "solids" instead of "thermophiles." Appropriate amendments have been made to Independent claims 22, 41, 48 and 55 to provide antecedent basis for "solids."

Rejection

Claims 22 – 32, 43, 50, 57 stand rejected under 35 USC 112, first paragraph, for want of an adequate written description in the application as originally filed, and objected to under

35 USC 132 and 35 USC 251 for addition of new matter. The rejection and objection are respectfully traversed.

Specifically, the Office action notes that the application as filed does not describe the simultaneous contacting of the polyquat and polyacrylamide with the biological sludge. The Office action further notes that the phrase, "along with a cationic polyacrylamide," does not mean, "added at the same time as."

Applicant does agree with the Examiner that column 5 lines 52-57 does describe a method one in which a polyquaternary amine is first added followed by addition of a cationic polyacrylamide. However, applicant respectfully disagrees that this limits method one. The plain English understanding of the phrase, "along with a cationic polyacrylamide," is that the polyquaternary amine is added at the same time as the cationic polyacrylamide, or that the cationic polyacrylamide follows. Applicant submits that one of ordinary skill would understand either as working. Col. 5, lines 52-57 merely illustrate one embodiment of the invention.

Accordingly, the claims have not been amended

Rejection

Claims 50 stands rejected under 35 USC 112(1) as failing to teach how to made or use the invention.

Claim 50 has been cancelled.

Rejection

Claims 2, 26, 30 stand rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. The rejection is respectfully traversed.

While claim 3 is not cited in the above rejection, reference is made in the Office action to claim 3. Applicant has treated the above rejection as also applying to claim 3.

The Office notes that there does not appear to be an art-recognized appreciation for which compounds are included in the "di-allyl di-methyl ammonium chloride . . . family," nor does applicant provide any such definition of said "family." The Office action further notes, that the compound di-allyl di-methyl ammonium chloride would unquestionably be a member of any such "family," but this observation only begs the question: What compounds other than the compound di-allyl di-methyl ammonium chloride would also unquestionably be a member of such a "family"?

In response applicant notes that di-allyl di-methyl ammonium chloride is not a single compound, but rather a "family" of compounds of various carbon chain lengths for the "allyl" group.

Regarding, claim 3, the Office action notes that similar grounds for rejection apply to claim 3 as well with respect to the so-called "epichlorohydrin di-methyl amine . . . family." Epichlorohydrin di-methyl amine appears to be but one compound.

In response, applicant agrees and has so amended claim 3 to recite that the ammonium compound is epichlorohydrin di-methyl amine.

Regarding claim 26, the Office action notes the notion of DADMAC "compounds" is not understood: DADMAC is a single compound. Similarly, epi-DMA is a single compound, not a group or family of compounds.

In response, again, DADMAC is a family of compounds having various numbers of carbon atoms in the allyl group. Applicant agrees that epi-DMA is a single compound. Claim 26 has been amended to remove "compounds" after "epi-DMA."

Claim 30 is not specifically recited in the details of the rejection, but it appears to have issues similar to claim 26. Claim 30 has been amended to remove "compounds" after "epi-DMA."

Rejection

Claims 44, 51 stand rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. The rejection is

respectfully traversed.

Specifically, the Office action notes that claim 44 recites "di-allyl di-methyl ammonium chloride . . . compounds," but neither the art nor the application as filed shed light on which compounds fall within this group which are not the single compound di-allyl di-methyl ammonium chloride. Similarly, the same can be said for "epichlorohydrin di-methyl amine . . . compounds."

In response applicant notes that di-allyl di-methyl ammonium chloride is not a single compound, but rather a "family" of compounds of various carbon chain lengths for the "allyl" group. Applicant agrees that epichlorohydrin di-methyl amine is a single compound and has so amended the claims

Rejection

Claim 19 stands rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. The rejection is respectfully traversed.

The Office action notes that claim 19 is ostensibly directed to a method, even though the claim from which it depends, namely, claim 15, is clearly directed to a composition of matter. The Office action further notes that while a reasonable effort has been made to reconcile this apparent inconsistency, such effort was to no avail, and could not render claim 19 reasonably precise in scope. Correction is being required, with the Examiner's kind suggestion being that claim 19 be cancelled in response to this rejection that is substantially related to patentability.

In response, method claim 19 is now dependent upon method claim 16.

Rejection

Claim 23 stands rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. The rejection is respectfully traversed.

Claim 23 has been cancelled.

Rejection

Claims 43, 45, 47, 52 are rejected under 35 USC 112, 2nd paragraph, for failing to particularly point out and distinctly claim the subject matter for which protection is sought. Claim 41, from which claim 43 depends, fails to describe the "polyacrylamide" recited in claim 43. Amendment from "polyacrylamide" to "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." Claim 41, from which claim 45 depends, also fails to describe the "cationic polyacrylamide" recited in claim 45. Amendment from "cationic polyacrylamide" to simply "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." See also claim 52. Claim 41, from which claim 47 depends, fails to describe the "polyacrylamide" recited in claim 47. Amendment from "polyacrylamide" to "acrylamide" would overcome this rejection, but see the new matter objection / rejection of claim 41 based on recitation of "acrylamide." Claim 48, from which claim 52 depends, also fails to describe the "cationic polyacrylamide" recited in claim 52. Amendment from "cationic polyacrylamide" to simply "polyacrylamide" would overcome this rejection.

In response, as claim 41 now recites "poly"acrylamide, there is antecendent basis for "polyacrylamide" of claims 43 and 47. Claims 45 and 52 have been amended to delete "cationic."

Rejection

Claims 1-8, 10-16, 19-20, 22-61, 67-71 stand rejected under §112, second paragraph, for failure to particularly point out and distinctly claim the invention. The rejection is respectfully traversed.

Specifically, the Office action notes that each pending claim is limited in part by either a step of providing a sludge that has been digested by a "thermophilic" digestion process or by the presence of "thermophiles." As further noted, the former limitation defines the temperature range at which the digestion process took place, and the latter limitation is defined by activity of bacteria in a specific temperature range. As even further noted, col 2 line 8-9 suggest that applicant understands "thermophilic" to being at about 115°F (about 46°C) while col 2 line 12 suggests that applicant understands "thermophilic" to being at about 131°F (about 55°C). As still further noted, it is unclear whether a sludge digested at a temperature more than about 46°C and less than about 55°C would qualify as a sludge that has been digested by a thermophilic process. As yet further noted, it is not reasonably clear to the skilled artisan whether a composition containing bacteria active at a temperature about 46°C but not active at about 55°C would meet the limitation of a "thermophile."

Examiner Barry has kindly suggested that a limitation to supported specific numerical temperature ranges (specifically recited in the claims) would overcome this rejection.

In response, applicant has provided a temperature limition of "greater than about 115°F" in independent claims 1, 15, 22, 33, 41, 48, 55, 62 and 67.

REJECTIONS UNDER 35 USC § 103

Dentel, Gould, and Buckman

The 1st 103 rejection is based on Dentel, Gould, and Buckman, with the 2nd 103 rejection being further in view of USP 6048438 to Rosencrance or USP 6025426 to Hurlock.

1st 103 Rejection

Claims 1, 3 – 8, 10-16, 19-20, 22-61,67-71 stand rejected under 35 USC 103(a) over Dentel, Gould, and Buckman. The rejection is respectfully traversed.

Regarding Dentel, applicant respectfully submits that Dentel actually teaches away from the use of HDTMA and/or ferric chloride followed by polyacrylamide.

Specifically, Dentel teaches away from the use of either ferric chloride or HDTMA, showing that better dewatering results and economic performance were obtained with the cationic polyacrylamide than with either ferric chloride or HDTMA individually or with either in combination with the cationic polyacrylamide.

Dentel concludes on page 11 by not recommending these combinations, "The use of ferric chloride or HDTMA as a preconditioner can reduce the polymer requirement, this is not a cost effective option at current prices for these additives." Further on page 10, "Although preconditioning with ferric chloride reduced the cationic polymer requirement, these results indicate that the process was not cost effective. The same conclusion is likely to apply in general since the relative costs of ferric chloride and the polymer would have to

change substantially to alter the trends shown in Figure 10." Further on page 9, "As a rule of thumb, it appears that adding a proportion of one chemical's optimum dose reduces the requirement for the other by the same amount. For example, the optimum dose of ferric chloride if used alone in conditioning the EBMUD sludge is about 560 mg/L; adding 50% of this dose reduced the polymer requirement to about 50% of its optimum dose is used alone. If this rule were invariably true, it would always be most economical to use only one of the conditioning chemicals by itself. However, the CST results also indicated that sole use of ferric chloride or HDTMA did not provide adequate dewaterability even at the optimum dose, so combined use may be desirable in some instances." Further on page 6, "Figures 1 and 2 show the results of conditioning and dewatering results for both the EBMUD and Philadelphia sludges, when conditioned with Percol 757, ferric chloride, or HDTMA individually. The results once again, confirm that cationic polymers are very effective in sludge conditioning when compared to the inorganic chemical conditioning with ferric chloride. Use of a cationic surfactant in sludge conditioning is unconventional, but its optimum dose on a mass basis was comparable to that of ferric chloride. However, this finding is of little practical use since HDTMA is significantly more expensive than ferric chloride or flocculant polymers per unit mass." Further, in relation to the practicality of the use of HDTMA since HDTMA is a biocide, on page 6, "Cationic surfactants such as HDTMA are also used as germicides, herbicides, fabric softeners, and corrosion inhibitors (Rosen 1989) and thus would require evaluation with respect to other impacts as well." This

is an important statement, as a primary application of recycled bio-solids is as a fertilizer; it therefore follows that the use of a biocide in a fertilizer brings forth many questions of practicality. Further, in relation to the theory of charge neutralization and dewaterability, pages 6 and 7, "We also measured SC values following conditioning, as shown in Figures 4 and 5 respectively for EBMUD and Philadelphia sludges. Comparison with Figures 1 and 2 shows that optimal CST values were invariably attained at an SC between -15 and -20. Our previous report to EBMUD also found an SC of -20 to indicate optimum dosages. This may be the level at which sufficient charge neutralization occurs to produce flocculation; since a negative offset is sometimes observed in SC readings relative to measured zeta potentials (Dentel, 1995), it is also possible that these values indicate true charge neutralization (zero zeta potential). Our comparison of SC readings with colloid titrations in a previous report to EBMUD supports this hypothesis (Dental et al., 1994). Although this argues for the importance of charge neutralization as a conditioning mechanism, quite different CST values were obtained with the best dosages for each conditioning chemical. For example, when sufficient HDTMA is added to the EBMUD sludge to give an SC of -20 (about 5000 mg/L), as CST is obtained of about 43 seconds; the ferric chloride dose giving this same SC leads to a much better CST of only 16 seconds, and the polymer dose at -20 gives a CST of 9 seconds. Thus, at equal degrees of charge neutralization, other factors must also be important in determining dewaterability.

The introduction on Dentel page 2 discusses that the means by which chemical conditioners interact with biological suspensions is poorly understood and that an understanding of the physical properties of the suspended solids is important along with an understanding of how the chemical conditioner interacts with the biosolids, "The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood, with the optimal amounts and types of conditioners required depending on a variety of factors. These include both aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids...Thus, the conditioning process is a multivariate problem with no simple strategy available for its optimization. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, the use of multiple chemical additive becomes less feasible because of the difficulty in identifying a proper dose combination...The inorganic conditioners require doses up to 20% on the dry solids basis and typically cannot produce the solids concentrations in dewatered biosolids that are attainable with much lower dosages of polymer. Thus in spite of their higher unit cost, organic polymers have largely displaced inorganic chemicals in sludge conditioning and dewatering processes. U.S. polymer sales for this purpose are estimated at $130 million per year (Dentel et al., 1995). The expense of polymer purchase is usually the greatest single cost component in biosolids management, and thus represents a considerable portion of overall treatment costs. At some treatment facilities where polymer demand is unusually high, this expense may even exceed secondary treatment aeration costs.

To summarize Dentel:

1. Dentel teaches away from the use of either *ferric chloride or* HDTMA as a bio-solid preconditioner, regardless of the type of bacteria.

2. In comparison to Dentel, the present invention obtains surprising results in that the economics of dewatering are improved, col. 4 lines 40-43, "The present invention provides a method for effectively and efficiently dewatering any sludge, with emphasis on dewatering biological sludge from a thermophillic digestion process." Again, col. 4 line 66 to col. 5 line 3, "Upon application of the present invention, plant throughput was increased by 300 percent (60 percent of rated capacity) and the dry polymer dosage requirement was reduced to near 850 ppm. The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

3. Dentel does teach that "The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood," He also teaches that, "the optimal amounts and types of conditioners required depending on a variety of factors. These include both aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids." In a direct teaching of the surface chemistry the present invention explains, col. 2 lines 25-36, "Despite the disadvantages of mesophillic bacteria, mesophillic bacteria are preferable in relation to the dewatering of digested sludge. Mesophillic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophillic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophillic bacteria naturally repel each other. This repelling nature of thermophillic bacteria makes the dewatering of sludge from the thermophillic digestion process expensive and difficult." Further, in a direct teaching of the chemistry of the chemical conditioner the present invention directly teaches, col.

5 lines 2-4, "The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

Regarding Gould, applicant respectfully submits that Gould actually teaches away from the difficulties of dewatering thermophillic biosolids, and thus away from the need for applicant's invention.

Specifically, at Gould, col. 2 lines 31-37, "The major reasons for commercial acceptance of anaerobic sludge digestion are that this method is capable of stabilizing large volumes of dilute organic slurries, results in low biological solids (biomass) production, produces a relatively easily dewaterable sludge and is a producer of methane gas." Further, col. 2 lines 40-43, "...anaerobic digestion is widely used in practice because it reduces the solid residue to a reasonably stable form which can be discarded as land fill without creating a substantial nuisance." Further, col. 4 lines 41-50, "Because of the more rapid oxidation of sludge, thermophillic digestion achieves more complete removal of biodegradable volatile suspended solids than the same period of digestion at ambient temperature. A more stable residue is obtained which can be disposed of without nuisance. It is also established that thermophillic digestion can effectively reduce or eliminate pathogenic bacteria in the sludge, thereby avoiding the potential health hazard associated with its disposal." Further, col. 9 lines16-26, "The present invention is based on the surprising discovery that an aerobic digestion zone operating in the thermophillic or near-thermophillic temperature regime may

advantageously be integrated with a downstream anaerobic digestion zone to provide partial digestion of sludge in each of the sequential zones, and that such integration provides substantial process improvement beyond that which would be expected based on consideration of the respective digestion steps in the treatment process taken separately," Further, col. 10 lines 21-43, "...it has unexpectedly been found that the deployment of a thermophillic or near-thermophillic aerobic digestion zone upstream of a mesophillic or thermophillic temperature anaerobic digestion zone and operation of these respective zones in accordance with the process of the present invention not only provides an operable and economic sludge treatment system but results in a digestion system with unique overall process improvements relative to prior art processes. For example, the process of the instant invention is able to provide a thermal operating stability in the overall sludge digestion system which it is not possible to achieve in either constituent digestion step operating alone. Furthermore, the integrated digestion process according to the present invention produces a highly stabilized sludge, despite a marked reduction in sludge retention time for the overall process beyond that which would be expected based on the anticipated additive retention time requirements for the constituent partial digestion steps."

Regarding Buckman, applicant respectfully submits that Buckman presents a different chemical system. In the abstract Buckman presents a three to four component system, "Water-soluble polymeric mixtures prepared by mixing 1 to 10 parts by weight of a

quaternary ammonium polymer with 0.5 to 7 parts by weight of a high molecular weight nonionic and/or cationic vinyl-addition polymer, and 0.1 to 5 parts by weight of a nonionic and/or cationic surfactant have utility in many diverse applications." Further, col. 1 lines 16-21, "More particularly, the mixture of polymers of our invention comprises a quaternary ammonium polymer limited to an aminoepichlorhydrin condensation polymer or an ionene polymer, a high molecular weight nonionic and/or cationic vinyl-addition polymer and a nonionic and/or cationic surfactant."

In addition to using a 3 to 4 component system as compared to the 2 or more component system presented by the present invention, Buckman presents the use of non-ionic surfactants and non-ionic polyacrylamides. The present teaches charge neutralization with polyquat (cationic) polymers only. It is doubtful that a non-ionic would perform at all with thermophiles. Knowing that non-ionic polymers would not work in the applications tested, The present specifically excludes non-ionic polymers, while specifically teaching polyquaternary amines, col. 5 lines 2-5, "The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

By comparison and using Dental as a reference, Buckman does not teach or discuss the aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also

important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids.

By comparison, The present teaches a system of two or more components, wherein all components are polymerized, no non-ionic polymers are utilized and no surfactants are utilized. In addition, The present teaches the dewatering of thermophillic bio-solids discussing the aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, as well as which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Further The present discusses the chemistry of any chemical conditioner used, and how it interacts with the biosolids. None of these are contemplated by Buckman.

Consequently, the combination of Dentel, Gould and Buckman does not disclose or suggest applicant's claimed invention, but rather teaches away from applicant's claimed invention.

2nd 103 Rejection

Claim 2 is rejected under 35 USC 103(a) over Dentel, Gould, and Buckman, alone or further in view of USP 6048438 to Rosencrance or USP 6025426 to Hurlock. The rejection is respectfully traversed.

The above comments relative to Dentel, Gould, and Buckman are repeated here. Neither of Rosencrance nor Hurlock add anything to the combination sufficient to overcome the above described teaching away.

It is noted that Rosencrance has a CIP filing date 14 months after the filing date of the present invention, while its parent application was filed a mere 10 months before the present invention. Clearly, material in the parent application may be cited as prior art (although applicant may be able to "swear behind" such material), and new matter in the CIP is not prior art. If Rosencrace is still asserted as a reference in the next Office action, applicant very respectfully requests that the priority of the asserted material back to the parent application filing date be shown, so that it can be determined whether it is necessary to "swear behind" the reference.

It is further noted that Hurlock has a CIP filing date a mere 4 months prior to the present application, with its parent application filed 13 months before the present application. Clearly, material in both the Hurlock CIP and parent application is prior art, but applicant may be able to "swear behind" material that was new matter in the CIP application. If Rosencrace is still asserted as a reference in the next Office action, applicant very

respectfully requests that the priority of the asserted material back to the parent application filing date be shown, so that it can be determined whether it is necessary to "swear behind" the reference.

Chitikela

The 3rd thru 8th 103 Rejections are all based on Chitikela in view of other references.

Thus, prior to discussion those rejections, Chitikela will be discussed.

Regarding Chitikela, at the outset, applicant very respectfully questions the assumption in the Office action that Chitikela was published August 18-21, 1996. Applicant very respectfully submits that the August 18-21, 1996 date on the face of the paper is merely the date of the Oral Presention of the paper, it is not proof that the paper was distributed on that day. As is customary, the "Proceedings" of a technical meeting follow the actual meeting itself, and can be several months or more later. Applicant very respectfully requests that proof of the publication date of the paper be provided. The copyright page merely shows the Proceedings were published in 1996.

As the present invention was published a mere one month after the meeting, a delay in the publication of the Proceedings of more than that amount of time (and that would not be uncommon, especially in 1996 before they slick desk top publishing software of today, then this would not be prior art). In addition, should the publication date truly be August 18-21, 1996, applicant may be able to "swear behind" the reference.

Regarding the substantive content of Chitikela, applicant notes that this paper is

substantially similar in disclosure to the "Dentel" paper discussed above (Dentel above is actually Dentel and Chitikela, while this is Chitikela and Dentel).

Accordingly, the same comments made above regarding Dentel are applicable here to Chitikela.

Specifically, Chitikela concludes on page 1-29 by not recommending these combinations, "The use of ferric chloride or HDTMA as a preconditioner can reduce the polymer requirement, this is not a cost effective option at current prices for these additives." Further on page 11-28, "Although preconditioning with ferric chloride reduced the cationic polymer requirement, these results indicate that the process was not cost effective. The same conclusion is likely to apply in general since the relative costs of ferric chloride and the polymer would have to change substantially to alter the trends shown in Figure 10." Further on page 11-28, "As a rule of thumb, it appears that adding a proportion of one chemical's optimum dose reduces the requirement for the other by the same amount. For example, the optimum dose of ferric chloride if used alone in conditioning the EBMUD sludge is about 0.56 g/L; adding 50% of this dose reduced the polymer requirement to about 50% of its optimum dose is used alone. If this rule were invariably true, it would always be most economical to use only one of the conditioning chemicals by itself. However, the CST results also indicated that sole use of ferric chloride or HDTMA did not provide adequate

dewaterability even at the optimum dose, so combined use may be desirable in some instances." Further on page 11-27, "The results once again, confirm that cationic polymers are very effective in sludge conditioning when compared to the inorganic chemical conditioning with ferric chloride. Use of a cationic surfactant in sludge conditioning is unconventional, but its optimum dose on a mass basis was comparable to that of ferric chloride. However, this finding is of little practical use since HDTMA is significantly more expensive than ferric chloride or flocculant polymers per unit mass." Further, in relation to the practicality of the use of HDTMA since HDTMA is a biocide, on page 11-27, "Cationic surfactants such as HDTMA are also used as germicides, herbicides, fabric softeners, and corrosion inhibitors (Rosen 1989) and thus would require evaluation with respect to other impacts as well." This is an important statement, as a primary application of recycled bio-solids is as a fertilizer; it therefore follows that the use of a biocide in a fertilizer brings forth many questions of practicality.

Chitikela on page 11-25 discusses that the means by which chemical conditioners interact with biological suspensions is poorly understood and that an understanding of the physical properties of the suspended solids is important along with an understanding of how the chemical conditioner interacts with the biosolids, "The optimal chemical conditioning and dewatering of a municipal sludge is a challenging task. The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood, with the optimal amounts and types of conditioners required depending on a variety of factors. These include both aqueous and surface chemistries of the sludge, and the physical properties of the suspended

solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids...Thus, the conditioning process is a multivariate problem with no simple strategy available for its optimization. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, the use of multiple chemical additive becomes less feasible because of the difficulty in identifying a proper dose combination...In addition, the use of cationic surfactants in sludge conditioning has not been previously reported, and we wished to examine the ability of such an additive to condition by charge neutralization alone." However, the results of the study do not support that hypothesis of charge neutralization, page 11-27, "Comparison of the results provided that optimal CST values were invariably attained at an SC between -15 and -20. This may be the level at which sufficient charge neutralization occurs to produce flocculation; since a negative offset is sometimes observed in SC readings relative to measured zeta potentials (Dentel, 1995), it is also possible that these values indicate true charge neutralization (zero zeta potential). Comparison of SC readings with colloid titrations in a previous report to EBMUD supports this hypothesis (Dental et al., 1994). Although this argues for the importance of charge neutralization as a conditioning mechanism, quite different CST values were obtained with the best dosages for each conditioning chemical. For example, when sufficient HDTMA is added to the EBMUD sludge to give an SC of -20 (about 5.0 g/l), as CST is obtained of about 43 seconds; the ferric chloride dose giving this same SC leads to a much better CST of only 16 seconds, and the polymer dose at -20 gives a CST of 9 seconds. Thus, at equal degrees of charge neutralization, other factors must also be important in determining dewaterability.

In summary:

1. Chitikela teaches away from the use of either ferric chloride or HDTMA as a bio-solid preconditioner, regardless of the type of bacteria.

2. In comparison to Chitikela, the present invention obtains surprising results in that the economics of dewatering are improved, col. 4 lines 40-43, "The present invention provides a method for effectively and efficiently dewatering any sludge, with emphasis on dewatering biological sludge from a thermophillic digestion process." Again, col. 4 line 66 to col. 5 line 3, "Upon application of the present invention, plant throughput was increased by 300 percent (60 percent of rated capacity) and the dry polymer dosage requirement was reduced to near 850 ppm. The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

3. Chitikela does teach that "The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood," He also teaches that, "the optimal amounts and types of conditioners required depending on a variety of factors. These include both aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids. In a direct teaching of the surface chemistry the present invention explains, col. 2 lines 25-36, "Despite the disadvantages of mesophillic bacteria, mesophillic bacteria are preferable in relation to the dewatering of digested sludge. Mesophillic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophillic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophillic bacteria naturally repel each other. This repelling nature of thermophillic bacteria makes the dewatering of sludge from the thermophillic digestion process expensive and difficult." Further, in a direct teaching of the chemistry of the chemical conditioner the present invention directly teaches, col. 5 lines 2-4, "The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

4. Chitikela does not obtain a correlation between charge neutralization and dewaterability. In fact the best results for dewaterability are obtained with the cationic polyacrylamide alone. Chitikela teaches to use the cationic polyacrylamide alone, even in high dosage polymer dewatering applications; this teaching is on the basis of both economics and dewaterability. In contrast, the present invention obtains surprising results, as compared to Chitikela in that the economics of dewatering are surprisingly improved, col. 4 lines 40-43, "The present invention provides a method for effectively and efficiently dewatering any sludge, with emphasis on dewatering biological sludge from a thermophillic digestion process." Again, col. 4 line 66 to col. 5 line 3, "Upon application of the present invention, plant throughput was increased by 300 percent (60 percent of rated capacity) and the dry polymer dosage requirement was reduced to near 850 ppm.

3rd 103 Rejection

Claims 1, 2, 4, 7, 16, 22 - 32 stand rejected under 35 USC 103(a) over Chitikela in view of Chung. The rejection is respectfully traversed.

Chitikela has been discussed above.

Regarding Chung, according to the abstract it discloses, "An improved method for dewatering aqueous sludge is disclosed comprising flocculating the sludge by the addition of effective amounts of chitosan and an organic dialdehyde such as gluteraldehyde to the sludge, which is also preferably acidified to about pH 6.0."

Further, Chung also supports the difficulty in biosolids dewatering, col. 1 lines 17-26, "The dewatering of sewage sludges is one of the most difficult processes to accomplish in sewage treatments. The main reason is that sludges have varying chemical and physical characteristics resulting from the many kinds of organisms which can be present (this definitely implies that changing to thermophiles would add difficulty), continuous changes of influent composition, and the variability between treatment plant equipment. For the purpose of sludge dewatering, the anionic nature of digested sludge had been employed to flocculate the sludge with cationic chemical polyelectrolytes."

Chung, col. 1 lines 56-62, "The present invention provides a method for dewatering aqueous sludge such as sewage sludge, which comprises mixing the sludge with an amount

of chitosan effective to flocculate the sludge solids and an amount of an organic dialdehyde effective to substantially strengthen the solid floc and to increase its settling rate. Further, col. 2 lines 32-39, "The chitosan employed in the present dewatering methods is a commercially-available material which can be prepared by the deacetylation of chitin by treatment of the chitin with hot concentrated aqueous sodium hydroxide (40-50%). Chitin [poly-beta-(1,4)-N-acetyl-D-glucosamine] is a mucopolysaccharide which is derived from marine invertebrates, insects, fungi and yeast."

However, Chung does not discuss thermophiles, polyquaternary ammonium compounds or quaternary ammonium compounds. Further, by reference to Chitikela, Chung does not discuss the aqueous and surface chemistries of the sludge, and the physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the biosolids.

Thus, the combination of Chitikela (i.e., a teaching away), and Chung (silent on thermophiles, polyquaternary ammonium compounds or quaternary ammonium compounds), does not disclose or suggest the present invention.

4th 103 Rejection

Claims 1, 2, 4, 7, 16, 22 - 32 stand rejected under 35 USC 103(a) over Chitikela in view of Chung as set forth above, further inview of Ghosh. The rejection is respectfully traversed.

Chitikela has been discussed above.

Regarding Ghosh, Ghosh provides no understanding of the difficulty to dewater thermophillic biosolids, and actually teaches that the biosolids are easily dewatered.

Ghosh presents per the abstract, "A process for improved methane production resulting in higher yield and higher production rates by anaerobic digestion of a mixture of plant material and organic waste...The process of this results in digester effluent which is easily dewatered and has a low concentration of soluble organics, providing easy disposal and recycling to the digester." Further, col. 1 lines 16-19, "The process may be carried out under mesophillic or thermophillic temperatures for detention times in excess of abut 5 days." Further, col. 3 lines 24-32, "The effluent from the anaerobic digestion of a mixture of plant material and organic waste has a low concentration of soluble organics indicating low ultimate disposal cost and the feasibility of its recycle to the anaerobic digester with little or no treatment. The digested effluent, although dilute, can be dewatered directly by vacuum filtration to provide cake-solids content and cake yield comparable to that of filtered, digested sewage sludge." Further, col. 3 lines 43-46, "It is yet another object of this

invention to provide a process for methane production by anaerobic digestion resulting in digester effluent which can be easily dewatered." Further, col. 4 lines 29-30, "Any active methane production mesophillic or thermophillic anaerobic digestion system may be used." Further, col. 6 lines 47-51, "The digester effluent had very low concentration of soluble organics and could be dewatered directly be vacuum filtration providing cake-solids content and cake yield comparable to that of filtered, digested sewage sludge."

Thus, the combination of Chitikela (i.e., a teaching away), and Ghosh (teaching the ease of dewatering), does not disclose or suggest the present invention.

5th 103 Rejection

Claims 1 – 4, 7,16, 22 – 32 are rejected under 35 USC 103(a) over Chitikela in view of USP 5451326 to Carlson. The rejection is respectfully traversed.

Chitikela has been discussed above.

Regarding Carlson, per the abstract, "The present invention provides a method for treating food processing wastes. Pursuant to the method, the food processing waste is treated with an effective amount of a dispersion of a water-soluble cationic polymer flocculant. In further embodiments, the method of the present invention includes the further steps of adding effective amounts of both a coagulant and flocculant in combination or separately." Further, col. 1 lines 7-12, "The present invention relates generally to the treatment of food processing wastes. More particularly, the present invention provides a chemical treatment method that effectively removes fat, blood, tissue and other solids from food processing waste."

Thus, the combination of Chitikela (i.e., a teaching away), and Ghosh (no disclosure of claimed chemical systems), does not disclose or suggest the present invention.

6th 103 Rejection

Claims 1 – 6, 7,16, 22 – 32 are rejected under 35 USC 103(a) over Chitikela in view of USP 5035808 to Hassick or USP 4450092 to Huang. The rejection is respectfully traversed.

Chitikela has been discussed above.

Regarding Hassick, Hassick provides no teachings on the dewatering of biosolids. Hassick presents no data or discussion as to the interchangeability of ferric salts and polyquaternary amines; Hassick presents the combination of ferric salts and polyquaternary amines. Per the abstract, "The use of flocculants of ferric salt water-soluble cationic polymer compositions having inorganic:polymer weight ratios of at least 5:1 is disclosed. These compositions are especially effective in low turbidity waters." Further, col. 1 lines 38-40, "The term flocculation, as used herein, is synonymous with the term coagulation." Further, col. 2 lines 3-14, "The instant invention relates to synergistic flocculation compositions comprising ferric sulfate and at least one water-soluble cationic polymer selected form the water-soluble dialky diallyl ammonium polymers, or comprising ferric chloride and a water-soluble polyamine, wherein the ferric salt to polymer weight ration is at least 5:1, on an active basis. Thus, the instant method utilizes synergistic compositions comprising a ferric salt and at least one water-soluble cationic polymer to accomplish clarification objectives." Further, col. 3 lines 3-6, "It is noteworthy that compositions comprising ferric chloride and

a dialkyl diallyl ammonium polymer are unstable in that they tend to form gels." Further, col. 3 lines 39-41, "The key to this invention is that the inventors have discovered a synergistic relationship between ferric salts and specific cationic polymers."

Accordingly, the combination of Chitikela and Hassick do not disclose or suggest applicant's claimed invention.

Regarding Huang, Huang investigates the combination of aluminum and ferric salts with positively charged polymer coagulants. Further, Huang does not discuss the dewatering of biosolids, much less the dewatering of thermophiles. Huang does not present interchangability of salts with polyquaternary amines, Huang discusses the benefits of their combination. Per the abstract, "Compositions useful for coagulating finely divided solids in turbid waters are prepared by mixing or blending together inorganic water soluble compounds such as aluminum chloride, aluminum sulfate, ferric chloride or ferric sulfate and water soluble organic positively charged polymeric coagulants having an average molecular weight of at least 2000 which is polydiallyl dimethylammonium chloride polymer. The composition is specially useful for treating low turbidity waters, for example, waters having a turbidity of 20 NTU (nephelometric turbidity units)." Further, col. 1 lines 23-31, "In accordance with the invention compositions are provided which are useful for coagulating finely divided solids in turbid waters and are prepared by mixing or blending together

inorganic water soluble compounds such as aluminum chloride, aluminum sulfate, ferric chloride or ferric sulfate and water soluble organic positively charged polymeric coagulants having an average molecular weight of at least 2000 which is polydiallyldimethyl ammonium chloride polymer." Further, col. 1 lines 66-68, "Since the compositions employed for the purpose of the invention are used in very small dosages measured in terms of parts per million (ppm) of the water being treated...."

Accordingly, the combination of Chitikela and Huang do not disclose or suggest applicant's claimed invention.

7th 103 Rejection

Claims 1 – 6, 7,16, 22 – 32 are rejected under 35 USC 103(a) over Chitikela in view of USP 5035808 to Hassick or USP 4450092 to Huang, as set forth above, further in view of Ghosh. The rejection is respectfully traversed.

All of these references have been discussed above, and these combinations do not disclose or suggest applicant's claimed invention.

8th 103 Rejection

Claims 15, 19, 33 – 40 are rejected under 35 USC 103(a) as being obvious over Chitikela in view of USP 4250269 to Buckman. The rejection is respectfully traversed.

Chitikela and Buckman have been discussed above and do not disclose or suggest applicant's claimed invention.

REQUEST FOR ALLOWANCE

Prompt allowance of all claims is respectfully requested. Examiner Barry is kindly invited to contact applicant's attorney, Mark Gilbreth at 713/667-1200, or in his absence, patent agent Mary Gilbreth, Ph.D. at 505/747-3909, to discuss any matters in this proceeding.

Respectfully submitted,

October 30, 2002

Date: ~~March 1, 2002~~

J.M. (Mark) Gilbreth

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CLEAN COPY OF THE CLAIMS

1. A method for dewatering biological sludge that has been digested by a thermophilic digestion process at a temperature greater than about 115°F, comprising:

a. adding a polymeric quaternary ammonium compound, as primary component, to the biological sludge; and

b. adding a polyacrylamide to the biological sludge;

such that any combination of the polymeric quaternary ammonium compound and of the polyacrylamide enhances dewatering of the sludge.

2. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is from the di-allyl di-methyl ammonium chloride (DADMAC) family.

3. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is epichlorohydrin di-methyl amine (epi-DMA).

4. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge and, upon formation of microflocs of the sludge from the polymeric quaternary ammonium compound, wherein the polyacrylamide is a cationic polyacrylamide and is added to form a floc that dewaters the sludge.

5. The method for dewatering biological sludge according to claim 4, wherein the polymeric quaternary ammonium compound and the cationic polyacrylamide are in an approximately 1:1 ratio, with the cationic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound does.

6. The method for dewatering biological sludge according to claim 4, wherein ratio of the polymeric quaternary ammonium compound with respect to the cationic polyacrylamide ranges from about 1:10 to about 20:1.

7. The method for dewatering biological sludge according to claim 4, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent.

8. The method for dewatering biological sludge according to claim 1, wherein the polymeric

quaternary ammonium compound is added directly to the sludge, in an amount sufficient to cause formation of a cationic overcharge within a developed microfloc system, wherein the polyacrylamide is a anionic polyacrylamide added for final floc formation.

9. Cancelled.

10. The method for dewatering biological sludge according to claim 8, wherein the polymeric quaternary ammonium compound and the anionic polyacrylamide are in an approximately 10:1 ratio, with the anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound.

11. The method for dewatering biological sludge according to claim 10, wherein the anionic polyacrylamide is about 40% anionic.

12. The method for dewatering biological sludge according to claim 8, wherein ratioof the polymeric quaternary ammonium compound to the anionic polyacrylamide ranges from about 1:10 to about 20:1.

13. The method for dewatering biological sludge according to claim 8, wherein polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50 ppm:1 percent and approximately 300 ppm:1 percent.

14. The method for dewatering biological sludge according to claim 1, wherein the biological sludge is mixed with primary sludge.

15. A composition comprising biological sludge that has been digested by a thermophilic digestion process at a temperature greater than about 115°F, comprising polymeric quaternary ammonium compound, as primary component, and polyacrylamide, said components being present in the composition in a ratio to enable dewatering of the biological sludge.

16. The method for dewatering biological sludge according to claim 1, wherein the polyacrylamide and the polymeric quaternary ammonium compound is used in solution or in dry form.

17. Cancelled.

18. Cancelled.

19. The method of claim of claim 16 wherein the polyacrylamide is cationic or anionic.

20. (New) The composition of claim 15 wherein the polyacrylamide is cationic or anionic.

21. Cancelled.

22. A method for treating a sludge comprising water and solids, wherein the solids comprise thermophiles, wherein the thermophiles comprise bacteria living at termperatures of greater than about 115°F, the method comprising:

contacting the sludge with a polymeric quaternary ammonium compound and a polyacrylamide to form a treated sludge;

wherein the contacting of the sludge with the polyacrylamide and polymeric quaternary ammonium compound is simultaneous, or the contacting of the sludge is first with the polymeric quaternary ammonium compound and then with the polyacrylamide.

23. Cancelled

24. The method of claim 22, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

25. The method of claim 22, wherein the polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of the thermophiles; and wherein the polyacrylamide is added in an amount sufficient to agglomerate the microflocs into flocs for dewatering.

26. (The Method of claim 25 wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

27. The method of claim 25, wherein ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

28. The method of claim 25, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

29. The method of claim 22, wherein the polymeric quaternary ammonium compound is added in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge, and wherein the anionic polyacrylamide is added for final floc formation.

30. The Method of claim 29 wherein the polymeric quaternary ammonium compound comprises

at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

31. The method of claim 29, wherein ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

32. The method of claim 29, wherein total concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

33. A method for treating a sludge comprising water and thermophiles, wherein the thermophiles comprise bacteria living at temperatures greater than about 115° F, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

34. The method of claim 33, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of greater than about 5,000,000.

35. The method of claim 33, wherein the polymer is added in an amount sufficient to form microflocs of the thermophiles.

36. The method of claim 35 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA) compounds.

37. The method of claim 35, wherein a concentration of polymer to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

38. The method of claim 33, wherein the polymer is added in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge, and wherein the anionic polyacrylamide is added for final floc formation.

39. The method of claim 38 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA) compounds.

40. The method of claim 38, wherein a concentration of polymer to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

41. A sludge composition comprising:
water;
polyacrylamide;
a polymeric quaternary ammonium compound; and

solids comprising thermophiles, wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

42. Cancelled

43. Cancelled

44. The sludge of claim 41, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

45. The sludge of claim 41, wherein a ratio of the polymeric quaternary ammonium compound to the polyacrylamide is in the range of about 1:10 to about 20:1.

46. The sludge of claim 41, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

47. The sludge of claim 41, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

48. A sludge composition comprising:
water;
a polyacrylamide;
a polymeric quaternary ammonium compound; and
solids comprising microflocs of thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

49. Cancelled

50. Cancelled

51. The sludge of claim 48, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA).

52. The sludge of claim 48, wherein a ratio of the polymeric quaternary ammonium compound to the polyacrylamide is in the range of about 1:10 to about 20:1.

53. The sludge of claim 48, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1

percent to about 300 ppm:1 percent.

54. The sludge of claim 48, wherein, the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

55. A sludge composition comprising:
water;
a polyacrylamide;
a polymeric quaternary ammonium compound; and
solids comprising an agglomeration of microflocs of thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F.

56. Cancelled

57. Cancelled

58. The sludge of claim 55, wherein the polymeric quaternary ammonium compound comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA) compounds.

59. The sludge of claim 55, wherein a ratio of the polymeric quaternary ammonium compound to the cationic polyacrylamide is in the range of about 1:10 to about 20:1.

60. The sludge of claim 55, wherein a concentration of quaternary ammonium compound and polyacrylamide to the percentage of solids in the sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

61. The sludge of claim 55, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, and the polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 15,000,000.

62. Cancelled

63. Cancelled

64. Cancelled

65. Cancelled

66. Cancelled

67. A sludge composition comprising:
water;
thermophiles wherein the thermophiles comprise bacteria living at temperatures greater than about 115°F; and
a polymeric quaternary ammonium compound.

68. The sludgeof claim 67 wherein the quaternary ammonium moity comprises at least one selected from the group consisting of di-allyl di-methyl ammonium chloride (DADMAC) compounds and epichlorohydrin di-methyl amine (epi-DMA) compounds.

69. The sludgeof claim 67, wherein the polymer is present in an amount sufficient to form microflocs of the thermophiles.

70. The sludgeof claim 67, wherein the polymer is present in an amount sufficient to cause formation of the thermophiles into a developed microfloc system having a cationic overcharge.

71. The sludge of claim 67, wherein, wherein the polymeric quaternary ammonium compound comprises a molecular weight in the range of at least about 5,000,000.

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1724

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FOR U.S. Patent No. 5,486,435

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(1) **Response to Office Action of August 30, 2002**; and
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Respectfully submitted,

Date: **October 30, 2002**

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